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## Brief Outlines of Research Findings

A physical explanation was given for the crack arrest mechanism in fiber reinforced composite materials. An award (Sawamura award) was given to this paper as the best paper in a year by Japan Society of Steels and Alloys.

Micromechanics of defects was studied completely in different direction (the inverse problem). This method provides a new approach of NDE (Nondestructive Evaluation) which can predict defects and integrity in materials or structures by knowing surface displacement change or measuring the surface tilts.

The most recent discovery is the following. When sliding occurs on the interface between matrix and inclusions (or inhomogeneities), the stress field  $\tau_{ij}(x)$  can be expressed by a linear combination of Eshelby's solution  $\sigma_{ij}^E(\epsilon^*)$  and Volterra's solution  $\sigma_{ij}^V(\mathbf{b})$ , i.e.,

$$\tau_{ij}(x) = \sigma_{ij}^E(\epsilon^*) + s\sigma_{ij}^V(\mathbf{b}).$$

The factor  $s$  represents the degree of relaxation and it can explicitly be determined for the spherical sliding inclusions in terms of material constants.

Publications and technical reports related to this project are listed in a separated sheet.

The following post doctor fellows participated in this project :

- |               |  |
|---------------|--|
| Dr. T. Mori   | Professor, Tokyo Institute of Technology, Japan.   |
| Dr. K. Tanaka | Professor, Nagaoka Institute of Technology, Japan. |
| Dr. A. Sato   | Professor, Tokyo Institute of Technology, Japan.   |

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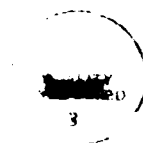


The following students participated and Ph.D. degree was awarded to them

Demitris Kourris     Assistant Professor, Arizona State University.  
 Z. Gao                 Assistant Professor, Clarkson University, N.Y.  
 Iwona Jasiuk          Assistant Professor, Michigan State University.

Professor Mura was made a honorary member of the Japan Institute of Metals Society due to his contributions to the field of metallurgy.

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1. Axisymmetrically Loaded Thin Circular Plate in Adhesive Contact with an Elastic Half-Space, by E. N. Mastrojannis *et al.*
2. The Elastic Field of a Hemispherical Inhomogeneity at the Free Surface of an Elastic Half Space, by D. A. Kouris and T. Mura.
3. A Dislocation Model for Hardness Indentation Problems -- I, by T. Mura *et al.*
4. A Dislocation Model for Hardness Indentation Problems -- II, by K. Tanaka *et al.*
5. The Hemispheroidal Inhomogeneity at the Free Surface of an Elastic Half Space, by D. Kouris *et al.*
6. Impotent Dislocation Walls, by T. Mura.
7. Inverse Problem in Plasticity, by T. Mura and Z. Gao.
8. Crack Arrest by Strong Short Fibers in a Composite, by S. Shibata *et al.*
9. Near Threshold Fatigue Curve Based on the Dislocation Shielding Model of Fracture, by S. J. Chang and T. Mura.
10. Octahedral Defects in a b.c.c. Lattice Examined by Lattice Theory, by A. Sato *et al.*
11. Crack Branching Behavior in Stress Corrosion Cracking of High Strength Steel, by Y. Hirose and T. Mura.
12. Nonlinearity of Inverse Problems, by T. Mura and Z. Gao.
13. An Inverse Problem in Elasticity with Overprescribed Boundary Conditions, by Weichung Yeih *et al.*
14. Frictional Sliding Inclusions, by Jin H. Huang *et al.*